

TFL 611: Continuous frost monitor with capillary sensor

How energy efficiency is improved

Demand-led, large-scale monitoring of installation parts with fully active sensor.

Areas of application

Temperature monitoring in air/water heat exchangers and air ducting with constant frost-protection control, frost-protection switch and temperature transmission. For applications on the air side of installations.

Features

- Measuring range: 0 to 15 °C
- Frost point can be adjusted
- Contact rating: 5 mA, 5 V to 6 A, 250 V
- Start-up function
- LED display indicating risk of frost
- Selectable block on switching on again
- < 40 s. time constant with moving air
- 2 or 6 m copper capillary tube

Technical description

- Two-part plastic housing
- Ambient temperature: -15 to +60 °C
- Controlled housing heating to safeguard measured variable
- IP 42
- Active from 25 cm capillary length in switching temperature

Type	Capillary tube	Setting range X _s °C	Switching diff. X _{sd} K	Permissible sensor temp. °C	Weight kg
TFL 611 F200 ¹⁾	2 m	1...10	2	-15...110	0,34
TFL 611 F600 ¹⁾	6 m	1...10	2	-15...110	0,41

Power supply	24 V~, ± 20%	Active capillary length ³⁾	min. 250 mm
Power consumption	6 VA	Factory setting	5 °C
Measuring range of sensor	0...15 °C / 0...10 V=	Temp. at head of instrument ⁴⁾	-15...60 °C
Control signal output	0...10 V=, max. ± 1 mA	Degree of protection	IP 42 (EN 60529)
Max. length of cable at 1,5 mm ²	300 m	Protection class	II (IEC 60730)
Control signal input	0...10 V=, max. ± 0,1 mA	Wiring diagram	A10390
Contact rating		Dimension drawing	M10422
maximum ²⁾	6(4) A, 250 V~	Fitting instructions	MV 505954
minimum	5 mA, 5 V~		
Time constant			
in still air	90 s		
in moving air	40 s		

Accessories

0292146 001* Set for duct fitting consisting of: 5 capillary-tube holders, 1 depth adjustable flange

0303167 000* 5 capillary-tube holders

0374534 001* Depth adjustable flange

^{*}) Dimension drawing or wiring diagram are available under the same number

1) The accessory 0292146 001 for duct fitting must be ordered separately.

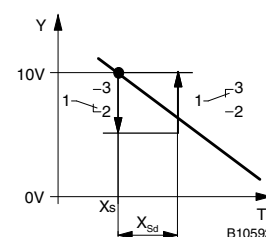
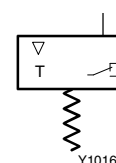
2) If under inductive load, take RC circuit into account.

3) The monitor always reacts to the coldest place (minimum length is 250 mm).

4) The head of the instrument is frost protected for ambient temperatures up to max. -15 °C by a heating system.



T10412



Operation

Using a vapour-filled capillary tube and diaphragm system, the frost monitor measures the lowest temperature that occurs anywhere along at least 250 mm of the capillary tube.

If the monitor is correctly positioned at the air outlet of the heating coil, it measures the lowest temperature even if there are strata of differing air temperatures. In so doing, the steam pressure causes a movement of the diaphragm capsule in the capillary tube. By means of an inductive measuring system, this movement is converted into an electric signal and is amplified electronically; it then creates a 0...10 V d.c. measuring signal.

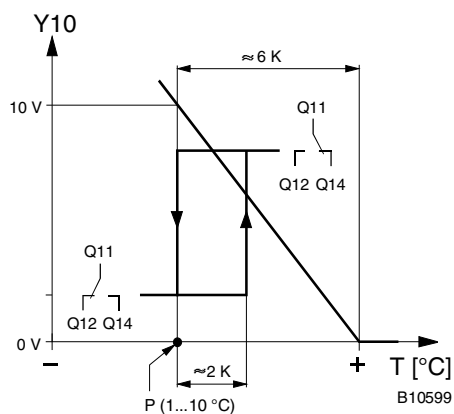
The TFL 611 fulfils its task with the aid of three independent functions:-

1. It continuously opens the heating valve within a proportional control range.
2. It switches the ventilators off and closes the dampers via its relay contacts.
3. It makes the measured temperature available for further processing.

The measuring signal is processed further for the monitor function and the valve control to the frost signal.

At about 6 Kelvin above the set frost point (P), the frost signal starts to rise.

Functional diagram



Key

P (Xs)	Frost point, variable
T	Capillary temperature
Y10	Valve control signal (when Y = 0 V d.c.)

Start-up function

The frost signal is added to the valve control signal that is fed to signal input Y. This causes the heating valve to be opened via signal output Y10 before the output relay is switched to the 'Frost' position (Q11-Q12). This circuit prevents the system from switching on and off several times when starting up. In order to ensure that the temperature measured at the capillary tube is always the lowest one, the temperature of the diaphragm capsule inside the housing must always be higher than the temperature of the capillary tube. This is achieved using the controlled heater that is installed in the housing as standard, which maintains a diaphragm capsule temperature of above 15 °C even at an ambient temperature of -15 °C.

Operating modes

There are three operating modes which can be selected using a rotary switch:-

- Automatic mode (Auto) After a frost shut-off, the output relay automatically returns to its normal position when the capillary tube temperature increases (> 2 K).
- Manual mode (Manu) After a frost shut-off, the output relay does not switch back (when the capillary tube temperature is increasing, i.e. > 2 K) until either the internal reset button has been pressed or the power supply has been switched off (using an external reset button if necessary).
- Test mode (Test) In test mode, the output relay is forced into the 'Frost' position. The valve control signal Y10 is not affected. When the equipment switches back to the 'Manu' switch position, the frost position is retained and can be cancelled using the reset button.

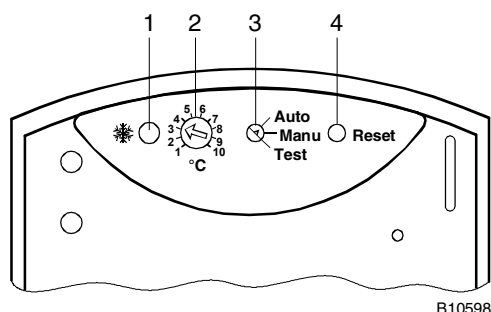
Features

The frost monitor consists of a two-piece plastic housing, a lower part and a lid, and a capillary that is active over its entire length. The lid is attached to the lower part of the housing with a screw. The housing contains: the electronic circuit, the diaphragm capsule with heater, the adjustment elements, the type plate and the connecting terminals.

The connecting terminals, the adjustment elements and the name plate are accessible after removing the lid. The cables can be routed at the bottom of the housing.

The wires can be fed through at the bottom of the housing. For this purposes, the housing has a break-out aperture without a thread for a M16 screw connection and two break-out inputs for additional M16 screw connections. The frost monitor is designed for direct wall mounting with or without a test loop, and also for wall mounting with a mounting flange (for air-duct insulation).

Setting elements



Key

- | | |
|---|---|
| 1 | LED indicator (red) denoting risk of frost |
| 2 | Potentiometer for setting the frost point |
| 3 | Mode switch with three operating modes: Auto, Manu and Test |
| 4 | Reset button for resetting the frost status in normal mode |

Engineering and fitting notes

The monitor requires a power supply of 24 V AC. A transformer for safety extra-low voltage (SELV) with separate windings and for 100% duty cycle should be used.

Fuses, switches, wiring and earthing should be implemented in accordance with local regulations. The maximum permissible cable lengths should be observed.

If the capillary becomes mechanically damaged or there is a leak somewhere in the diaphragm system, the frost monitor simulates a low temperature and moves to the 'Frost' position. The same applies in the event of a power failure or when important electronic components malfunction.

Where to fit

On the warm side of the heating coil (air/water heat exchanger).

Fitting the housing

Direct fitting

Fit the housing (with its integrated fixing holes) onto the wall of the heating coil. Protect the capillary tube in the air-duct hole with the rubber plugs provided.

If fitting inside the duct, fit the housing to the inside wall of the heating coil, feeding the capillary tube through a housing hole at the side.

Direct fitting, with test loop for operational test

Fit the housing (with its integrated fixing holes) to the wall of the heating coil, feeding the capillary tube through a housing hole at the side. Form a test loop with the capillary tube and then feed the capillary tube into the air duct. Protect the capillary tube in the air-duct hole with the rubber plugs provided.

This method of fitting is unsuitable if the ambient temperature at the test loop (which is outside) can fall below that at the place of measurement in the air duct (the measuring signal of the sensor always equates to the lowest temperature, wherever it occurs on the capillary tube).

With accessory 0292146 001

Suitable for air ducts with insulation of up to 70 mm.

Fit the flange onto the wall of the heating coil and feed the capillary tube through the flange into the air duct.

Fitting the capillary tube

Wind the capillary tube in coils, keeping the same distance, around the whole heating coil and fix to the fins with spacer clamps at a distance of about 50 mm to the fins (accessory 0303167).

Note

The capillary tube should not be bent sharply. Any bends should have as large a radius as possible.

Fitting notes

The connection terminals are protected against being wired up incorrectly with regard to own voltages of up to 24 V a.c. There is no protection against incorrect connection of 230 V a.c. mains.

Putting into service

The frost monitor should be put into service and set up in accordance with the instructions supplied.

The frost monitor can be tested for correct operation with a test loop using an ice/water mixture.

The relay output can be checked using the operating-mode switch (in the 'Test' position).

Additional technical data

Conforms to:-

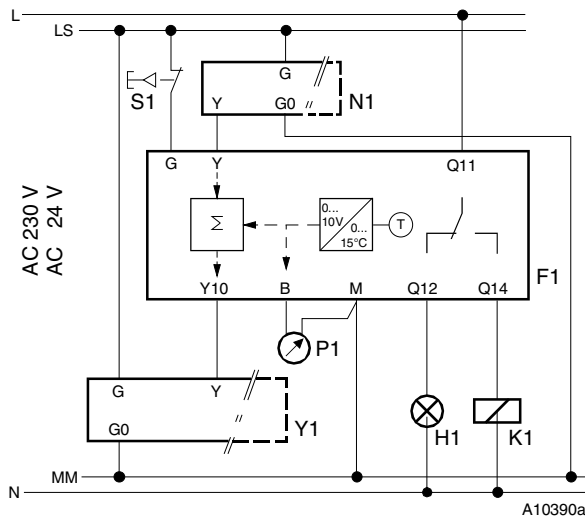
Low-voltage directive 2006/95/EC EN 60730-1

EMC directive 2004/108/EC

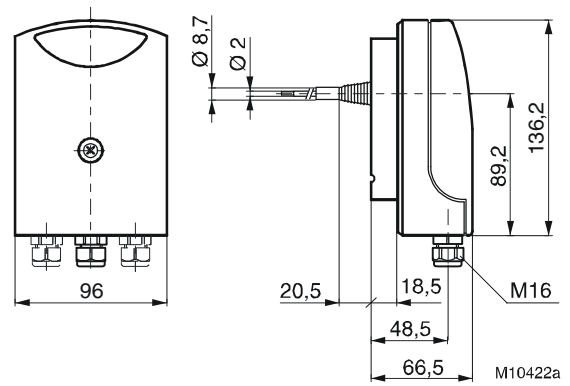
EN 61000-6-1/ EN 61000-6-2

EN 61000-6-3/ EN 61000-6-4

Wiring diagram



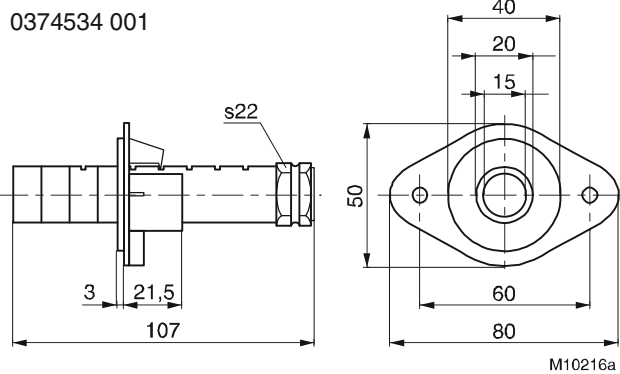
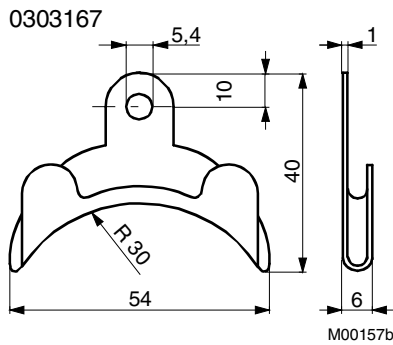
Dimension drawing



Key

F1	TFL 611 frost monitor	G	System power (SELV) 24 V a.c.	
N1	Controller with 0...10 V d.c. control signal	M	System zero, measuring zero	
H1	e.g. external frost transmitter	B	Measuring signal output 0...10 V d.c. $\hat{=}$ 0...15 °C	
K1	e.g. ventilator protection	Y	Signal input for 0...10 V d.c. controller valve control signal	
P1	e.g. temperature indicator with signal input 0...10 V d.c. and display range of 0...15 °C	Y10	Signal output for 0...10 V d.c. valve control	
S1	If required: button for external release of frost position	Q11	} Relay contacts 5...250 V a.c./d.c.	
Y1	Control element with 0...10 V d.c. control signal input	Q12		Closed when risk of frost
		Q14		

Accessories



0292146 001:
5 pcs. 0303167 000 + 1 pcs. 0374534 001